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Listing of Claims

Claim1. (Original) A method of synchronizing a base station with a remote terminal, in which the base station has a base oscillator, the base oscillator having a base sample period, and in which the remote terminal has a remote oscillator, the remote oscillator having a remote sample period, the method comprising the steps of:

transmitting a training sequence from the remote terminal to the base station over a channel;

upon receipt of the training sequence at the base station, transmitting a first vernier signal from the base station to the remote terminal over the channel, in which the first vernier signal comprises successive time segments, each time segment being offset in time from a multiple of the remote sample period by different multiples of a fraction of the remote sample period;

identifying a time segment in the successive time segments that upon receipt by the remote terminal most closely matches the remote oscillator;

determining a first time offset between the base oscillator and the remote oscillator from the identified time segment; and

advancing signals transmitted from the base station to the remote terminal by the first time offset.

Claim2. (Original) The method of claim 1 further comprising the step of adjusting signals transmitted from the base station to reduce effects of the channel before transmitting the first vernier signal to the remote terminal.

Claim3. (Original) The method of claim 1 further comprising the steps of:

transmitting a second vernier signal from the base station to the remote terminal over the channel after transmitting the first vernier signal;

determining a second time offset from the second vernier signal;

determining a frequency offset between the base oscillator and the remote oscillator from the

first time offset and the second time offset; and

periodically adjusting the advancing of signals transmitted from the base station to the remote terminal to account for changes in time offset between the base oscillator and the remote oscillator.

Claim 4. (Original) The method of claim 1 in which identifying a time segment in the successive time segments that most closely matches the remote oscillator is carried out by using early-late synchronization.

Claim 5. (Original) The method of claim 1 further comprising the step of adjusting the time offset for variation in time offset between the base oscillator and the remote oscillator by:

transmitting a series of early-late pulses from the base station to the remote terminal;

identifying whether the early-late pulses are early or late; and

adjusting the time offset of signals transmitted from the base station to the remote terminal according to whether the early-late pulses are early or late.

Claim 6. (Original) The method of claim 1 in which each succeeding time segment of the successive time segments is offset by successive multiples of a fraction of the remote sample period.

Claim 7. (Original) The method of claim 1 in which each succeeding time segment of the successive time segments is advanced by successive multiples of a fraction of the remote sample period

Claim 8. (Original) The method of claim 1 in which the fraction has the form 1/N where N is an integer.

Claim 9. (Original) The method of claim 1 in which the time segments uniformly cover the sample period.

Claim 10. (Original) A base station for synchronizing a telecommunications network, the telecommunications network incorporating a remote terminal having a remote oscillator, the remote oscillator having a remote sample period, the apparatus comprising:

a transmitter comprising a digital to analog converter and a pre-equalizer filter;

a receiver comprising an analog to digital converter and a post-equalizer filter;

a base oscillator, the base oscillator having a base sample period, the base oscillator being connected to supply a clock signal to the digital to analog converter and to the analog to digital converter;

a frame counter connected to receive a clock signal from the base oscillator;

an equalization controller connected to the pre-equalizer filter to provide radio channel corrections and a timing advance to signals transmitted from the base station and connected to the post-equalizer filter to provide radio channel corrections and a timing advance to signals received from the terminal;

a synchronization controller connected to receive frame position information from the frame counter, the synchronization controller being connected to receive signals from the receiver and being configured to determine a timing advance required to adjust the base oscillator to be synchronized to the remote oscillator, the synchronization controller being connected to supply the timing advance to the equalization controller; and

the synchronization controller being configured to generate a vernier signal, in which the vernier signal comprises successive time segments, each time segment being offset in time from a multiple of the remote sample period by different multiples of a fraction of the remote sample period.

Claim 11. (Original) The base station of claim 10 in which the receiver is connected to the equalization controller and the synchronization controller through a channel detector, and the channel detector is configured to determine coefficients for the post-equalizer filter and the pre-equalizer filter that model the effect of the radio channel.

Claim 12. (Original) The base station of claim 10 in which the receiver comprises a post-equalizer filter connected to the equalization controller to receive channel equalization coefficients and channel offset correction coefficients from the equalization controller.

Claim 13. (Original) The base station of claim 10 in which the equalization controller is configured to monitor time variation of timing offset between the base oscillator and the remote oscillator and to correct timing advance according to the time variation of the timing offset.

Claim 14. (Original) The base station of claim 11 in which, in the vernier signal, each succeeding time segment of the successive time segments is advanced by successive multiples of a fraction of the remote sample period.

Claim 15. (Original) The base station of claim 10 in which the time segments uniformly cover the sample period.

Claim 16. (Cancelled)

Claim 17. (Cancelled)

Claim 18. (Original) A base station for synchronizing a telecommunications network, the telecommunications network incorporating a remote terminal having a remote oscillator, the remote oscillator having a remote sample period, the apparatus comprising:

a transmitter comprising a digital to analog converter and a pre-equalizer filter;

a receiver comprising an analog to digital converte;

a base oscillator, the base oscillator having a base sample period, the base oscillator being connected to supply a clock signal to the digital to analog converter and to the analog to digital converter;

a frame counter connected to receive a clock signal from the base oscillator;

an equalization controller connected to the pre-equalizer filter to provide a timing advance to signals transmitted from the base station;

a synchronization controller connected to receive frame position information from the frame counter, the synchronization controller being connected to receive signals from the receiver and being configured to determine a timing advance required to adjust the base oscillator to be synchronized to the remote oscillator, the synchronization controller being connected to supply the timing advance to the equalization controller; and

the synchronization controller being configured to generate a vernier signal, in which the vernier signal comprises successive time segments, each time segment being offset in time from a multiple of the remote sample period by different multiples of a fraction of the remote sample, the time segments uniformly covering the sample period.

Claim 19. (Original) The base station of claim 18 in which, in the vernier signal, each succeeding time segment of the successive time segments is advanced by successive multiples of a fraction of the remote sample period.